In reference to FIG. **3**, the operation of alternate removable illuminator assembly can be seen. Holder **120** slides laterally into alternate receiver assembly **110** in much the same manner as in FIG. **2**, except that holder **120** slides into receiver assembly **110** from left to right. Again, receiver ball **58** presses into detent hole **70** allowing laser assembly **118** to be installed and removed with slight lateral pressure.

In this alternate assembly, laser **76** is aligned in a lateral direction such that emitted beam **138** impinges on mirror surface **126** and results in reflected beam segment **140**. The angle of mirror surface **126** can be changed to redirect beam segment **140** onto cantilever **30** as in FIG. **3**.

A source of electrical power (not shown) is connected to receiver board leads **116**. As assembly **118** slides into receiver assembly **110**, laser vertical board **144** presses against receiver vertical board **146** making electrical contact between laser leads **78** and receiver board leads **116**. This connection provides electrical power to laser **76**.

FIG. **3**A shows how the angle of mirror surface **126** is adjusted. Elastic pad **130** is sandwiched between mirror plate **128** and holder **120**. Mirror plate **128** compresses elastic pad **130** when screws **124** are tightened. Consequently, mirror **132** will rotate about the point where the end of pivot pin **142** and holder **120** meet.

Referring to FIG. **5**, oscillator device **164** causes stylus **46** to vibrate and periodically approach and withdraw from sample **28** in a conventional manner. Magnetic sensing material **168** senses any magnetic fields emanating from sample **28**. The interaction of sensing material **168** and any magnetic fields from sample **28** causes cantilever **30** to deflect.

Referring to FIG. **6**, sample **28** is submersed in conventional fluid **160**. Both sample **28** and fluid **160** are contained in fluid container **162**. Alternate probe illuminator assembly **158** is positioned such that cantilever **30** and stylus **46** are submersed in fluid **160** in a conventional manner.

SUMMARY, RAMIFICATIONS, AND SCOPE

The scanning force microscope just described attaches the illuminator assembly to the moving portion of the scanning mechanism and provides easy installation on, and removal from, the microscope. The cantilever can then be replaced on the removed assembly without stressing or contaminating the lateral or vertical drive mechanisms. The laser beam can also be conveniently aligned while the assembly is removed from the microscope thereby avoiding damage to the lateral or vertical drive mechanisms. After installation of the prealigned illuminator assembly on the microscope, the light beam accurately tracks the motion of the cantilever as it scans over the surface of the sample. Further, the use of low mass components in the illuminator assembly, reduces the mass of the moving elements and the system is able to scan at a faster rate.

The description given above is quite specific and detailed. It should not limit the scope of the invention but should instead be viewed as only a description of some examples of the invention. There are many alternate variations of the invention.

The connection mechanism for the illuminator assembly may be made as shown above using a lateral or vertical slide operation. Connection may also be made by lateral or vertical insertion or by a combination of sliding and rotating or insertion and rotation.

The scanning mechanism can take many forms. The vertical and lateral drivers can be piezoelectric blocks, stacks, tubes, bimorphs, or flexures. Piezoelectric devices can actuate the vertical and lateral drivers. Magnetic or magnetostrictive devices can also be used as such drivers. The vertical and lateral drivers can be combined into a single piezoelectric tube which can create relative motion in the x, y, and z direction with respect to the sample surface.

The light source can be a laser, a light emitting diode, or an incandescent source. The examples show the reflected beam location detectors as photodiodes, but there are other types of devices that can detect light. Consequently, the light detecting devices can be phototransistors. If an array of four or more light detecting devices is employed, the lateral motion of the beam as well as the vertical motion can be detected.

The detector assembly with its associated light sensitive devices may also be mounted to the illuminator assembly such that there is no need to align the detector assembly after installation of the illuminator assembly. This added benefit comes at the cost of increased mass of the moving portion of the microscope and would, to some extent, limit the scanning speed of the microscope.

The scanning force microscope described here can operate with the sample submerged in fluids. Further, the microscope can operate by oscillating the cantilever and detecting some parameter of the oscillation such as the amplitude, frequency, or phase change. The oscillating cantilever may actually come into intermittent contact with the sample surface.

In the examples, a stylus creates a bending action of the cantilever. However, other types of probes, such as magnetic probes, can bend the cantilever.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.

I claim:

1. A scanning force microscope comprising:

(a) a light source,

(b) a cantilever,

(c) an illuminator assembly comprising said light source and said cantilever, and

(d) scanning means for moving said illuminator assembly relative to a sample, where said illuminator assembly is removable from said scanning means, and where said light source directs a light beam onto said cantilever.

2. The scanning force microscope of claim **1** further including a stylus attached to said cantilever, and where said cantilever deflects as a result of forces acting on said stylus where said forces result from the proximity of said stylus to said sample.

3. The scanning force microscope of claim **1** further including magnetic field sensing means attached to said cantilever, and where said cantilever deflects as a result of forces created by the interaction of said magnetic field sensing means and said sample.

4. The scanning force microscope of claim **1** where said scanning means includes at least one piezoelectric tube.

5. The scanning force microscope of claim **1** where said light source receives electrical power through a first set of at least two electrical conductors and a second set of at least two electrical conductors, where said first set of at least two electrical conductors is fixed to said scanning means, and makes electrical contact with said second set of at least two electrical conductors where said second set of at least two electrical conductors are fixed to said illuminator assembly.

6. The scanning force microscope of claim **1** further including a sample where said cantilever comprises a stylus